LIVING WITH A VOLCANO IN YOUR BACKYARD
VOLCANIC HAZARDS AT MOUNT RAINIER

The magnificent cone of Mount Rainier has repeatedly undergone sudden, dramatic change. Eruptions of lava and ash have built the cone thousands of feet above the surrounding terrain while other geologic forces— glaciers, landslides, and debris flows—have acted to tear it down. Landslides and debris flows are particularly hazardous because although they happen relatively infrequently, when they happen in the future, they could have a destructive effect on people in nearby communities.

What is the greatest hazard presented by Mount Rainier?

Debris flows pose the greatest hazard to people near Mount Rainier. A debris flow is a mixture of mud and rock debris that looks and behaves like flowing concrete. Giant debris flows sometimes develop when large masses of weak, water-saturated rock slide from the volcano's flanks. Many of these debris flows cannot be predicted and may even occur independently of a volcanic eruption. Giant debris flows can also form during an eruption as hot rock fragments tumble down the volcano's slopes, eroding and melting snow and glacier ice.

Although they happen infrequently, giant debris flows have the potential to inundate much of the southern Puget Sound lowland. Scientists estimate that debris flows can travel the distance between Mount Rainier and the Puget Sound lowland in as little as 30 minutes to a few hours. About 100,000 people now live in areas that have been buried by debris flows during the past few thousand years.

Why is Mount Rainier prone to debris flows?

Hot, acidic ground water circulates through the interior of Mount Rainier. Over time, some layers of volcanic rock alter to clay. Giant landslides occur when clay layers become so weak that they can no longer support the weight of overlying rock. During eruptions, hot rocks falling on snow and glacier ice produce large quantities of melt water that mix with loose rocks and form debris flows.

How often do giant debris flows happen?

During the past 10,000 years, about 60 giant debris flows from Mount Rainier have filled river valleys to a depth of hundreds of feet near the volcano, and have buried the land surface under many feet of mud and rock sixty miles downstream. Seven debris flows large enough to reach Puget Sound have occurred in the past 6,000 years.

What areas are at risk from debris flows?

Valleys that head on Mount Rainier are at great risk from debris flows. Dams and reservoirs would at least partly block giant debris flows moving down all river valleys that originate at Mount Rainier, except for the Puyallup River valley. However, the largest debris flows would not be contained by reservoirs. Instead, enough water could be displaced from reservoirs to cause devastating floods far downstream.

What other hazards does Mount Rainier present?

Volcanic ash can be hazardous over great distances. Volcanic ash is erupted into the air above a volcano, carried downwind, and eventually falls to the ground. Most volcanic ash consists of fine, dusty particles. Because the wind usually blows from the west, ashfall will usually be heaviest to the east of Mount Rainier. However, different wind conditions could produce ashfall in communities to the west, along Puget Sound. In small quantities, volcanic ash is more a nuisance than a threat. Ash can disrupt regional ground and air traffic and cause respiratory problems for some people.

Lava flows are usually hazardous only on the flanks of the volcano. Those at Mount Rainier move fairly slowly and rarely extend more than a few miles from the summit. People in the path of lava flows would have ample time to evacuate. However, lava moving across glaciers and snow fields can produce enough water to cause floods and debris flows that could affect areas far downstream.

Volcanic eruptions sometimes involve powerful blasts of hot rock and gases directed "sideways" instead of upward. Such a blast at Mount St. Helens in 1980 was responsible for the deaths of 57 people. Giant landslides are sometimes accompanied by "sideways" volcanic blasts. A "sideways" blast from Mount Rainier would probably be preceded by bulging of one side of the mountain, thereby indicating the direction in which the blast would probably travel.

How would an eruption of Mount Rainier compare to the 1980 eruption of Mount St. Helens?

Eruptions of Mount Rainier usually produce much less volcanic ash than do eruptions at Mount St. Helens. However, owing to the volcano's great height and widespread cover of snow and glacier ice, eruption-triggered debris flows at Mount Rainier are likely to be much larger—and will travel a greater distance—than those at Mount St. Helens in 1980. Furthermore, areas at risk from debris flows from Mount Rainier are more densely populated than similar areas around Mount St. Helens.

Can scientists predict the timing and type of future volcanic eruptions?

The best guide to predicting the nature of future eruptions of Mount Rainier is geologic evidence left by previous eruptions. By studying this evidence, scientists have identified the types of possible events—including debris flows, ashfall, volcanic blasts, and lava flows—and their likely size. But a volcano's history cannot be used to make specific predictions about when the next eruption will occur.

Mount Rainier erupts sporadically, with periods of inactivity that typically last for centuries. Oral histories of Northwest native peoples mention eruptions of Mount Rainier, and at least two small eruptions occurred in the 19th century, during the early years of U.S. settlement of the region. The last giant eruption-triggered debris flow occurred about 500 years ago, and the last lava flows that added new rock to the volcano's summit occurred between 1,200 and 2,100 years ago.

What are the usual warning signs of an eruption?

The most important indication that an eruption may occur is concentrated earthquake activity *beneath the volcano*, including a special sort of earthquake—volcanic tremor—caused by magma rising toward the Earth's surface. Other warning signs might include increased flow of certain gases released by rising magma, geyser-like releases of steam, or development of a bulge on the side of the volcano. In the case of Mount St. Helens in 1980, warnings of an impending eruption began 2 months before the actual eruption. At some other volcanoes, warning signs have not been detected until a few hours or days before an eruption. In other cases, similar warning signs have not been followed by eruptions.

How are public agencies responding to the threat of future geologic unrest at Mount Rainier?

Earthquakes in the vicinity of the Cascade volcanoes are currently being monitored by the University of Washington and the U.S. Geological Survey. After Mount Rainier reawakens, scientists will install additional equipment to detect debris flows, earthquakes, and changes in the shape of the volcano. They will also measure volcanic-gas emissions that might indicate rising magma (molten rock). Emergency information centers will be established to provide accurate, timely information about the volcano. Such information will allow public officials and private citizens to make informed decisions about the need for emergency procedures. Although the probability of large debris flows or eruptions occurring in our lifetimes is low, the consequences of these events could be severe. Some communities already take volcanic hazards into account when building schools, hospitals, and other structures in areas at risk. Some social-service organizations are developing plans for evacuation and care of clients in the event of a volcanic emergency. With some low-cost, common-sense measures, risks to people and property posed by Mount Rainier can be minimized.

Further reading

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—Joseph S. Walder and
Carolyn L. Driedger

View across Puyallup River valley toward Mount Rainier

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For additional information about volcano hazards at Mt. Rainier or other volcanos, contact:

U.S. Geological Survey
Cascades Volcano Observatory
5400 MacArthur Blvd.
Vancouver, Washington 98661

Telephone: (360) 696-7693
Fax: (360) 696-7866
E-mail: cvo@pwavan.wr.usgs.gov
Internet:http://vulcan.wr.usgs.gov/